Self-renewal of human embryonic stem cells

Grant Award Details

Self-renewal of human embryonic stem cells

Grant Type: SEED Grant

Grant Number: RS1-00327

Investigator:

Name:	Qilong Ying
Institution:	University of Southern California
Type:	PI

Human Stem Cell Use: Embryonic Stem Cell

Award Value: $621,421

Status: Closed

Progress Reports

Reporting Period: Year 2

View Report

Grant Application Details

Application Title: Self-renewal of human embryonic stem cells

Public Abstract:

Human embryonic stem (ES) cells are a remarkable cell type that are derived from a group of cells called the inner cell mass (ICM) of a very early stage embryo (about 100 cells in total) obtained from in vitro fertilization program. Human ES cells can be expanded in culture in an undifferentiated state (self-renewal) without limit while retaining the capacity to differentiate into nearly any type of cell. Human ES cells offer an important renewable resource for future cell replacement therapies for many diseases such as Parkinson's disease, spinal cord injury etc. However, before the full potential of human ES cells can be exploited in the clinic, we need to understand more about human ES cells so we can control their fate towards either self-renewal or towards differentiation into a specific cell type required for cell replacement therapy. Currently it is a problem just to grow human ES cells, let alone to understand how human ES cells make their choice between self-renewal and differentiation. In contrast, several signaling pathways which are important for mouse ES cell self-renewal have been identified, and as a result of this, it is possible to grow mouse ES cells in a fully defined condition. However, these pathways seem to be not operating in human ES cells. This would argue that human ES cells are very different from mouse ES cells, and that understanding of human ES cells may not benefit from the research of mouse ES cells. However, we have recently made striking discoveries on mouse ES cells. We found that for mouse ES cell self-renewal does not require any added growth factors or cytokines but only the elimination of signals that induce differentiation. These new findings provide us with a new prospective to understand human ES cells. Through understanding some of the basic mechanisms involved in human ES cell maintenance, we should be able to develop a more efficient and better method to grow human ES cells, which is clearly important if these cells are to be used clinically.

Statement of Benefit to California:

Human embryonic stem (ES) cells can be maintained indefinitely while retaining the ability to make any type of human tissue. In the future, human ES cells may hold the key to replacing cells lost in many devastating diseases such as Parkinsons and diabetes. But for human ES cells to be of use clinically, they will first have to be multiplied in very large numbers. Scientists must, therefore, learn how to control the growth of stem cells in the laboratory. When a human ES cell divides it can either produce identical copies of itself (self-renewal) or it can produce other more specialised cell types, such as nerve or muscle cells. Understanding how a stem cell makes this choice between self-renewal and differentiation is the central challenge in stem cell research. This proposal is intended to apply the knowledge we obtained from extensive research on mouse ES cells for the better understanding how human ES cells make their decision whether to self-renewal or to differentiate. The direct benefit from this proposal research will be the development of more efficient culture conditions for the growth of human ES cells, which is a critical step leading to the clinical application of human ES cell-derived cells.
